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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-181619

(43)Date of publication of application : 06.07.1999

(51)Int.Cl.

D01F 6/06
C04B 16/06

(21)Application number : 09-362913

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(22)Date of filing : 12.12.1997

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(54) HIGHLY HEAT-RESISTANT POLYPROPYLENE FIBER AND FIBER-REINFORCED CEMENT MOLDED PRODUCT USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a polypropylene fibrous material without completely fusing in autoclave curing at $\geq 170^{\circ}\text{C}$ as a cement concrete reinforcing fiber, especially a highly heat-resistant polypropylene fiber excellent in shape retaining properties at the time of the autoclave curing at $170-180^{\circ}\text{C}$ and simultaneously having the affinity for the cement concrete and antimicrobial properties of the fiber surface.

SOLUTION: This highly heat-resistant polypropylene fiber is obtained by melt spinning a resin composition prepared by adding 0.05-2 pts.wt. of a Zn- containing nucleating agent or a resin composition obtained by adding 0.05-2 pts.wt. of the Zn-containing nucleating agent and 0.03-5 pts.wt. of a bivalent metal compound to 100 pts.wt. of a homopolypropylene or an ethylene-propylene copolymer with ≤ 0.5 wt.% content of ethylene having $\geq 95\%$ isotactic pentad fraction, 3-12 molecular weight distribution and 0.5-50 g/10 min melt flow rate and then drawing the resultant fiber. Furthermore, the cement molded product prepared by compounding the fiber can be obtained.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's
decision of rejection]

[Date of requesting appeal against
examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The high thermal-resistance polypropylene fiber to which an isotactic pentad molar fraction comes to extend the gay polypropylene 3-12, and whose melt flow rate molecular weight distribution are 0.5-50g / 10 minutes, or the resin constituent with which the ethylene content carried out 0.05-2 weight section addition of the Zn content ***** to 0.5 or less % of the weight of the ethylene-propylene-rubber 100 weight section after melt spinning 95% or more.

[Claim 2] The high thermal-resistance polypropylene fiber according to claim 1 which is Zn content polymer ***** to which Zn content ***** makes Zn glycerate or Zn propane trihydrate which is 40% or more of Zn content the principal component of composition.

[Claim 3] The high thermal-resistance polypropylene fiber to which an isotactic pentad molar fraction comes to extend the gay polypropylene 3-12, and whose melt flow rate molecular weight distribution are 0.5-50g / 10 minutes, or the resin constituent with which the ethylene content carried out 0.03-5 weight section addition of 0.05 - 2 weight section and the divalent-metal compound for Zn content ***** to 0.5 or less % of the weight of the ethylene-propylene-rubber 100 weight section after melt spinning 95% or more.

[Claim 4] The high thermal-resistance polypropylene fiber according to claim 3 whose divalent-metal compound it is Zn content polymer ***** to which Zn content ***** makes Zn glycerate or Zn propane trihydrate which is 40% or more of Zn content the principal component of composition, and is a zinc compound.

[Claim 5] The fiber strengthening cement moldings which comes to blend a claim 1 or a high thermal-resistance polypropylene fiber given in four to the mud set method.

[Claim 6] The fiber strengthening cement moldings according to claim 5 which comes to carry out 0.5-10 capacity % combination of the high thermal-resistance polypropylene fiber to the mud set method.

[Claim 7] The claim 5 the average size of 0.5 deniers or more and whose length of fiber a high thermal-resistance polypropylene fiber is 3-30mm, or a fiber strengthening cement moldings given in six.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the high thermal-resistance polypropylene fiber for cement concrete reinforcement, and the cement moldings using it especially about a high thermal-resistance polypropylene fiber.

[0002]

[Description of the Prior Art] The cement moldings is used for interior material, a sheathing material, roofing, etc. as a building-materials use from the former. Although the product which added asbestos fiber conventionally as reinforcement fiber of these cement concrete moldings is used widely, the bad influence to asbestine health is regarded as questionable in recent years as especially an environmental problem becomes severe. Carcinogenic [asbestine] is regarded as questionable in Europe and America, and use of this alternative fiber is increasing every year. It has become in the direction which does not use asbestos in a ceramic industry and a building-materials field according to the movement of these West by self-imposed control of the industry of administrative guidance of a related government office, an asbestos-cement product maker, etc. in our country. Although natural fibers, such as fiber of minerals, such as synthetic fibers, such as a polypropylene fiber, a polyethylene fiber, the poly acrylic fiber, a vinylon, a polyamide fiber, and a polyester fiber, and alkali-proof glass fiber (ARG), paper, pulp, linen, and cotton, the carbon fiber, etc. are proposed as reinforcement fiber which substitutes for this asbestos, the present condition is that the satisfactory performance is not necessarily obtained. In recent years, polyolefine fiber is beginning to be used especially as alternative fiber which does not have a bad influence in a human body.

[0003] In the stage of performing the fabrication, cement needs care-of-health process. 170-180 degrees C of care of health are performed within an autoclave (10 kgf/cm²) for dozens hours.

However, in the usual polypropylene fiber, since the melting point is 160-165 degrees C, bearing this care of health cannot be finished, it dissolves, and the problem to which polypropylene does not exist as fiber in cement concrete after a care-of-health end arises. If the curing temperature of concrete is lowered to 165-170 degrees C, it will be needed for care of health for a long time, and a productivity fall will be caused. Furthermore, polypropylene was a nonpolar nature macromolecule, and since it being water repellence and specific gravity were smaller than cement concrete, it was difficult for it to make it distribute uniformly at the process of mixing, and it had the problem on which productivity is reduced. In addition, since there was no compatibility with cement, it could draw out easily and the not high fault had the reinforcement effect of a cement precast concrete considering fiber intensity compared with the asbestos use product. Although the proposal of the method of fibrillating fiber, the method of hydrophilicity-izing a fiber front face, the method of split-face-izing, etc. has accomplished as a cure to these, it has not resulted in fundamental solution.

[0004] On the other hand, although a natural fiber excels the case of a synthetic fiber in a miscibility and compatibility, the aging decomposition on account of a natural fiber does not have multiplication of the microorganism which is not avoided, but carries out adhesion breeding and has a bad influence on fiber desirable at interior material etc. for reasons of sanitation. If it says which is a cement concrete moldings, it will be the product used semipermanently and microorganism degradation in a natural fiber, a synthetic fiber, etc. will become fatal. Moreover, the inorganic fiber degradation with the synthetic fiber or asbestos fiber, although there is no problem of

microorganism degradation or decomposition.

[0005]

[Problem(s) to be Solved by the Invention] this invention offers the polypropylene fiber which does not carry out a complete fusion at 170 degrees C or more of autoclave curing, and the high thermal-resistance polypropylene fiber which was especially excellent in form maintenance nature at the time of 170-180-degree C autoclave curing, and possessed the cement concrete compatibility on the front face of fiber, and antibacterial simultaneously as cement concrete reinforcement fiber from the above-mentioned viewpoint.

[0006]

[Means for Solving the Problem] As a result of inquiring wholeheartedly that the above-mentioned technical problem should be attained, this invention persons found out that the polypropylene fiber which has high thermal resistance, cement compatibility, and antibacterial ability was obtained from the constituent which blended Zn content ***** or Zn content ***** , and the divalent-metal compound with polypropylene with molecular weight, specific molecular weight distribution, and specific stereoregularity, and completed this invention. An isotactic pentad molar fraction invention of the 1st of this invention Namely, 95% or more, The gay polypropylene 3-12, and whose melt flow rate molecular weight distribution are 0.5-50g / 10 minutes, The resin constituent with which the ethylene content carried out 0.05-2 weight section addition of the Zn content ***** to 0.5 or less % of the weight of the ethylene-propylene-rubber 100 weight section Or after melt spinning, It is the high thermal-resistance polypropylene fiber which it comes to extend. the 2nd invention The gay polypropylene 3-12, and whose melt flow rate 95% or more and molecular weight distribution are 0.5-50g / 10 minutes for an isotactic pentad molar fraction, Or it is the high thermal-resistance polypropylene fiber which comes to extend the resin constituent with which the ethylene content carried out 0.03-5 weight section addition of 0.05 - 2 weight section and the divalent-metal compound for Zn content ***** to 0.5 or less % of the weight of the ethylene-propylene-rubber 100 weight section after melt spinning. Furthermore, invention of the 3rd of this invention is the fiber strengthening cement moldings which blended the above-mentioned quantity thermal-resistance polypropylene fiber.

[0007]

[Embodiments of the Invention] 1. Polypropylene Resin in Polypropylene Resin this Invention The isotactic pentad molar fraction (henceforth IPF) which is the index of stereoregularity is 96% or more preferably 95% or more. molecular weight distribution (Mw/Mn) -- 3-12 -- desirable -- 3-9 -- and a melt flow rate (It is hereafter called MFR) are 0.5-50g / gay polypropylene that fills 1.0 - 10g / 10 minutes preferably for 10 minutes, and an ethylene content is 0.2 or less % of the weight of an ethylene propylene rubber preferably 0.5 or less % of the weight. The melting temperature of the polypropylene resin concerned and its moldings is low in IPF being less than 95%, and it is not desirable as cement reinforcing materials. When performing melt spinning as MFR is less than 0.5, it is necessary to make molding temperature into an elevated temperature, and it is inferior to a moldability, and is not economically desirable. Moreover, if MFR exceeds 50g / 10 minutes, although it becomes it is satisfactory to perform melt spinning itself and good [itself], the heat-resistant improvement at the time of autoclave curing will become difficult. Furthermore, trouble will not be caused to spinning and extension if the molecular weight distribution of polypropylene resin are within the limits of 3-12 by the GPC method. Although spinning nature is excellent in molecular weight distribution being less than three, the melting temperature of fiber becomes low and is not desirable as cement reinforcing materials. On the other hand, since it is inferior to spinning nature when 12 is exceeded, it is not desirable. Especially when spinning nature / ductility is taken into consideration, 3-9 are more desirable.

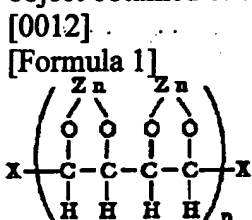
[0008] In the case of an ethylene propylene rubber, an ethylene content is 0.5 or less % of the weight. If an ethylene content exceeds 0.5 % of the weight, it will become difficult for the crystallization temperature of an ethylene propylene rubber to be low, and for weld of polypropylene fibers to start and to perform melt spinning from a bird clapper. Moreover, since IPF also falls, the heat-resistant improvement at the time of autoclave curing becomes difficult.

[0009] If the amount of heat of fusions (**Hm) is polypropylene of 105 or more j/g even if gay polypropylene is desirable and is the ethylene propylene rubber of minute amount ethylene content

as polypropylene resin, the thermal resistance at the time of a regimen is maintainable by adding Zn content ***** given in this invention.

[0010] 2. The GURISE rate-Zn complex ($C_3H_6O_3Zn$) obtained by the US patent No. 4,544,761, AU JP,584238,B, etc. according to the method of a publication, for example as Zn content ***** used in Zn content ***** this invention is mentioned. The divalent-metal compound and multi-hydroxyl-group compound which contain zinc as a synthetic method, and a catalyst (an acid or acid salt) are mixed under temperature (the range of 120 degrees C - 300 degrees C, preferably for 120-200 degrees C) sufficient under existence of the catalyst of a stoichiometry-amount to react mutually, and the method of obtaining the polymerization matter is mentioned.

[0011] Here, multi-hydroxyl-group compounds are the shape of a straight chain which has a hydroxyl group, and an organic compound which branched, and the length of a chain has the hydroxyl group at the end by C2-C33. It has the hydroxyl group at the end by C2-C12 more preferably. Generally the polymerization of a zinc oxide and a multi-hydroxyl-group compound is dehydration. The multi-hydroxyl-group compound used for this invention has triol and a desirable diol, and propane triol, its ethylene glycol, etc. are especially desirable. Thus, the zinc glycerate polymerization object which makes the following structure expression a skeleton as a polymerization object obtained can be illustrated.



In the above-mentioned structure expression, n is 1-1000, although it changes on polymerization conditions, and the ranges of usually desirable average molecular weight are 1000-200,000. X is hydrogen, a hydroxyl group, a methyl group, etc.

[0013] the loadings of Zn content nucleating additive concerning this invention -- the polypropylene resin 100 weight section -- receiving -- 0.05 - 2 weight section -- it is 0.2 - 1 weight section preferably Under in the 0.05 weight section, even if the gestalt retentivity in autoclave curing of extension thread is bad and contains more than 2 weight sections, the predominance of the gestalt retentivity effect in autoclave curing is not accepted, but a productivity issue, such as causing the thread breakage etc. conversely at the time of spinning, produces it. Furthermore, as for especially antibacterial [of the polypropylene fiber obtained], the performance of Zn content nucleating additive improves above the 0.5 weight section. The ***** concerned may be blended at the time of polypropylene constituent manufacture, may be masterbatch-ized, and may carry out dryblend to polypropylene resin.

[0014] 3. -- the divalent-metal compound used by the divalent-metal compound this invention -- the [, such as magnesium, calcium, zinc, strontium, and barium,] -- it is an oxide, a hydroxide, or a carbonate of II group metal etc. It is a zincky compound preferably and a zinc oxide, a zinc carbonate, zinc hydroxide, zinc acetate, benzoic-acid zinc, etc. are mentioned. the loadings of the divalent-metal compound concerning this invention -- the aforementioned Zn content ***** -- in addition, the polypropylene resin 100 weight section -- receiving -- 0.03 - 5 weight section -- it is 0.2 - 2 weight section preferably In under the 0.03 weight section, even if the gestalt maintenance student and cement compatibility in autoclave curing of extension thread are bad and contain more than 5 weight sections, since a productivity issue, such as not accepting but causing the thread breakage etc. conversely at the time of spinning, arises, the predominance of the gestalt retentivity effect in autoclave curing is not desirable. The divalent-metal compound concerned may be blended at the time of polypropylene constituent manufacture, may be masterbatch-ized, and may carry out dryblend to polypropylene resin.

[0015] 4. For the extension fiber of the polypropylene resin concerning other additive this inventions, the well-known modifier for polyolefines can be used together suitably conventionally according to the purpose of use. For example, they are an antioxidant, an ultraviolet ray absorbent, a light stabilizer. an antistatic agent (surfactant ****), a neutralizer, an epoxy stabilizer, a plasticizer,



lubricant, an antimicrobial agent, a flame retarder, a bulking agent, a foaming agent, a foaming assistant, a cross linking agent, a bridge formation assistant, a pigment, etc. As an antioxidant, a phenol system antioxidant, the Lynn system antioxidant, a sulfur system antioxidant, an amine system antioxidant, and vitamins are mentioned. As a neutralizer (it serves also as a dispersant), a metallic soap, hydrotalcites, a lithium aluminum compound hydroxide salt, a silicate, a metallic oxide, a metal hydroxide, etc. are mentioned.

[0016] 5. Fabrication of manufacture the non-extended thread of the manufacture method (1) the non-extended thread of a high thermal-resistance polypropylene fiber is melting fabrication, and, generally is performed by melting extrusion molding. Let Zn ***** content polypropylene resin constituent of this invention be a raw material for polypropylene fibers. The polypropylene raw material for fiber is made into the shape of the shape of a pellet, and powder, and non-extended thread is obtained using multifilament melt spinning equipment or monofilament melt spinning equipment. After carrying out spinning, subsequently it extends with extension equipment.

[0017] (2) Although extension operation spinning and extension can also be performed by the single step, they can separate spinning and an extension process and can also be performed by two steps or two steps or more of multi-stage extensions. The range of extension temperature is 70-150 degrees C, and it performs extension operation by making oven, a hot platen, far infrared rays, warm water (wet heat), etc. into a heat source. In the case of general fiber, draw magnification is two to 7 times preferably 1.5 to 10 times, although fiber with high tensile strength is obtained so that draw magnification is high.

[0018] (3) Heat treatment, thus the obtained polypropylene fiber can be heat-treated by request. Generally, 130-170 degrees C, the range of this heat treatment is 140-165 degrees C, and it is preferably performed for 1 - 20 minutes for 0.5 to 30 minutes. Crystallization of the orientation crystal section advances with this heat treatment, and the further high-melting point-ization is brought about. When carrying out autoclave curing, in order to raise and go over 2 - 5 hours slowly to the purpose temperature of 170-180 degrees C, it is the same situation as having heat-treated to the polypropylene fiber as a result. For this reason, you may carry out to serve also as heat treatment at the time of autoclave curing.

[0019] 6. As cement applied as cement reinforcing materials, the fiber of the cement this invention to which the fiber of this invention is applied as cement reinforcing materials can usually mention special cement, such as non-hydraulic cement, such as hydraulic cements, such as Portland cement, a white portland cement, alumina cement, a pozzolanic cement, magnesia cement, and Pozzolan cement, plaster, and coal, and an acid resisting cement, etc., for example. Moreover, it can obtain by blending thermosetting water soluble resins, such as the aggregates, such as a pebble and sand, paraffin, a wax, and resol type phenol resin, various kinds of polymer emulsions, a hardening accelerator, a concrete retarder, a water reducing agent, the silica fume as a chemical admixture, etc. with an inner kind of the cement mentioned above, or two sorts or more as a cement constituent using the above-mentioned cement inorganic material, such as a calcium carbonate, a magnesium hydroxide, or a titanium white, and if needed, for example. When stiffening this cement constituent, as for the mixing ratio of the cement at the time of adding the cement and water at the time of adding water to a cement constituent, and water, and the so-called C/W ratio, it is desirable to consider as the range of 1-10. The amount of a C/W ratio of water increases too much or less in one, and if the intensity of a cement hardened material does not become high enough but it becomes large from 10, the fluidity of a cement constituent will get worse.

[0020] 7. Blend the high thermal-resistance polypropylene fiber of a high thermal-resistance polypropylene fiber strengthening cement moldings this invention with cement as cement reinforcing materials, and process it into a cement concrete moldings by paper milling, the extrusion method, etc. When using the fiber of this invention as cement reinforcing materials, after cutting fiber in length of 3-30mm, it is desirable to mix and use into the above-mentioned cement constituent. In this case, since it becomes impossible to acquire sufficient reinforcement effect when fiber length is longer than 30mm and it is [it is hard coming to distribute in a cement constituent uniformly and] conversely shorter than 3mm, it is not desirable. Moreover, the average size of fiber has desirable 0.5 deniers or more, and it is 20-80 deniers more preferably. Since fiber becomes easy to be involved and dispersibility becomes bad when the average size of fiber mixes cement concrete in less than 0.5

deniers, it is not desirable.

[0021] moreover, the amount of mixing to the cement of the high thermal-resistance polypropylene fiber of this invention -- cement -- receiving -- 0.5 to 10 capacity % -- it is one to 7 capacity % preferably although the reinforcement effect and antibacterial will improve under by 0.5 capacity % if sufficient reinforcement effect cannot be acquired and 10 capacity % is exceeded, it is not desirable in order that a fault, like the front-face nature of that the dispersibility to the cement concrete of fiber falls and a cement concrete moldings is inferior may come out Various cement products are mentioned as a fiber strengthening cement moldings of this invention. For example, the structures, such as passages, such as the underwater structures, such as a tetrapod, a bridge, and a tunnel, the structure for railroads and a building, a residence (interior material, sheathing material), and a wall surface, a revetment block, a tile, etc. can be mentioned.

[0022]

[Example] Below, an example explains this invention in detail. The examining method in an example is as follows.

(1) MFR:JIS K It measured at 2.16kg of loads, and 230 degrees C by 7210.

(2) Molecular weight distribution : it measured in GPC.

(3) IPF : it is an isotactic molar fraction in the pentad unit in the polypropylene chain measured by ray ZAMBERI and others (A. Zambelli) using the nuclear-magnetic-resonance spectrum (13 C-NMR) by isotope carbon according to Macromolecules, six volumes, and the method announced by 925 pages (1973). That is, an isotactic pentad molar fraction is a molar fraction of the propylene unit in which five propylene monomeric units carried out isotactic combination continuously. However, about attribution of a peak, it carried out based on Macromolecules, eight volumes, and the revised edition of the above-mentioned reference of a 687 pages (1975) publication. Specifically, the isotactic pentad unit was measured with the on-the-strength molar fraction of the mmmm peak in a full energy peak of the methyl carbon field of 13 C-NMR spectrum.

(4) DSC measurement : about sample (extension thread) about 10mg, the temperature up was part [for scanning temperature/of 10 degrees C] carried out from the room temperature to 210 degrees C, and dissolution peak temperature (TMp) and dissolution end temperature (TmE) were measured.

[0023] (5) Spinning nature : the following criteria estimated the thread-breakage frequency produced in case melt spinning is carried out using a multifilament spinning machine with a gear pump at the molding-temperature spinning temperature of 250 degrees C, and 400m a part for /and cooling temperature of 20 degrees C in winding speed.

O : what the thread breakage does not produce under the above-mentioned conditions at the time of continuation 3-hour spinning.

O : what the thread breakage produced once under the above-mentioned conditions at the time of continuation 3-hour spinning.

** : What the thread breakage produced twice under the above-mentioned conditions at the time of continuation 3-hour spinning.

x : What the thread breakage produced 3 times under the above-mentioned conditions at the time of continuation 3-hour spinning.

[0024] (6) Gestalt retentivity after a regimen : the cement moldings after a regimen was broken and the following criteria estimated from the configuration state of the thread of the cross section.

O : the thing in the state where the configuration of the thread of a cross section remained completely.

O : a thing with the state where it became a little distorted although the configuration of the thread of a cross section remained.

** : What a part of configuration of the thread of a cross section melts, and gestalt change is regarded as.

x : The configuration of the thread of a cross section melts and gestalt change is remarkable.

[0025] (7) Cement compatibility measurement : the cement moldings after a cement regimen was broken and it judged on the following criteria from the state of the thread of the cross section.

O : the thing in the state where cement keeps good relations on the surface of thread, and cannot draw out after the configuration of the thread of a cross section has remained completely.

O : a thing with ***** which can be drawn out in part although the configuration of the thread of a

cross section remains firmly.

x: The thing in the state where the thread of a cross section can be drawn out easily.

[0026] (8) Antibacterial : the cement moldings after a regimen was broken, the cross section was used for the analyte, and the antibacterial examination (halo test) was measured the following condition.

Examination bacillus: After cultivating *Staphylococcus aureus*, *Escherichia coli*, a *Klebsiella pneumoniae* culture-medium: nutrient broth culture medium, a nutrient agar medium, and the phosphoric-acid physiology buffer-solution examining method: examination fungus liquid by the nutrient broth culture medium for 24 hours, it diluted with the phosphoric-acid physiology buffer solution, and considered as examination fungus liquid. After having fed 5g of staple fibers of this invention into 100ml Erlenmeyer flask [finishing / sterilization], adding 10ml of examination fungus liquid to it and shaking at 25-30 degrees C for 20 hours, examination fungus liquid was diluted suitably and the number of micro organisms was measured. In addition, the rate of sterilization could be a rate of sterilization, having applied it to the value which divided the number of bacilli which subtracted the number of micro organisms of a sample from the number of micro organisms of contrast by the number of micro organisms of contrast. (The following formula) After number-of-micro-organisms x100 and the halo test of rate (%) of sterilization = (number of micro organisms of number-of-micro-organisms-log sample of log contrast)/log contrast cultivated the examination bacillus among the nutrient broth culture medium for 24 hours, respectively, they were diluted with the phosphoric-acid physiology buffer solution, and were taken as examination fungus liquid. Seeding of every 0.1ml of this examination fungus liquid was carried out to the nutrient agar medium. After carrying the analyte (the cement moldings after a regimen was broken and the cross section was made into the analyte) on the agar medium which inoculated the bacillus and cultivating for 48 hours, it judged antibacterial on the following criteria by the existence of the rejection band (portion into which the bacillus is not growing) made to the circumference of an analyte.

O : what the above-mentioned rate of sterilization is 50% or more, and can check the growth rejection band of a bacillus by the halo test.

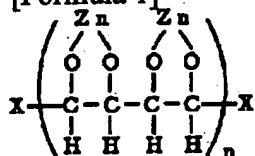
O : what the above-mentioned rate of sterilization is 40% or more, and can check the growth rejection band of a bacillus by the halo test.

** : What cannot check the growth rejection band of the bacillus of a halo test although the above-mentioned rate of sterilization is 30% or more.

x: What the above-mentioned rate of sterilization is 25% or less of thing, and cannot check the growth rejection band of the bacillus of a halo test.

[0027] For 98% and molecular weight distribution, 5 and MFR are [example 1IPF] as an antioxidant to the gay polypropylene for 2g / 10 minutes. Respectively tetrakis [methylene-3-(3, 5-G t-butyl-4-hydroxyphenyl) propionate] methane (Ir1010, product made from Ciba-Geigy), and a tris (2, 4-G t-buthylphenyl) force fight (Ir168, product made from Ciba-Geigy) The 0.1 weight section, as a sulfur system antioxidant -- pentaerythrityl tetrakis (3-laurylthio propionate) (SHINOKKUSU 412S --) The zinc glycerate rate polymerization object which made the following structure expression the skeleton for made in SHIPRO Chemicals as the 0.2 weight section and a neutralizer as the calcium stearate 0.05 weight section and Zn system ***** (compound A) [0028]

[Formula 1]



After adding the 0.2 weight section and blending (Prifer3881, product [made from Uniqema International], and molecular weight >140,000) using a super mixer, melting kneading was carried out with the screw speed of 230 degrees C and 70rpm with the extruding press machine of 50mmphi, and pellet-like polypropylene was obtained. Melt spinning of this was carried out using the multifilament spinning machine with a gear pump at the spinning temperature of 280 degrees C, and 200mm a part for land cooling temperature of 20 degrees C in winding speed, and about 30-denier

non-extended thread was obtained. Subsequently, it extended under the conditions with a part for feed speed 50m/, the feed roll temperature of 90 degrees C, 130 degrees C [of heater temperature of an extending point], and a draw roll temperature of 110 degrees C for draw rise speed 150m/, and 3 times as many draw magnification as this and fiber with an average size of about 10 deniers were obtained.

[0029] After cutting the extension fiber obtained as mentioned above in length of 15mm, Portland cement, No. 8 silica sand, and water were made to mix into the cement constituent which blended and becomes by the weight ratio so that it may be set to Portland cement:silica sand:water =100:100:60. in addition, the mixing ratio of a cement constituent and the above-mentioned fibrous cement reinforcing materials -- a capacity factor -- cement constituent: -- fibrous -- it was referred to as cement reinforcing materials =100:2 The cement fibrous reinforcing materials mixture obtained as mentioned above was slushed into the mold with a length of 80mm, a width of face [of 30mm], and a height of 20mm, and, subsequently autoclave curing was performed for the following low pressure steam curing on the 1st on the 1st.

Low pressure steam curing: Carry out an isothermal regimen for 3 to 5 hours after recuperating oneself at 23 degrees C for 2 to 5 hours and raising at 20 degrees C/hour in speed to 65 degrees C. It cools slowly to 23 degrees C over 10 - 15 hours after that.

Autoclave curing: Maintain **, such as an isothermal, for 3 to 5 hours after supplying to an autoclave iron pot, applying for 3 to 6 hours, after unmolding, and heating and pressurizing to 180 degrees C and ten atmospheric pressure. Water is filled in the space of the outer wall of the successor, and it cools over 7 - 10 hours to it.

The cement concrete moldings after this autoclave curing was evaluated (gestalt retentivity, antibacterial, cement compatibility). The result is shown in Table 1.

[0030] For 97% and molecular weight distribution, 7 and MFR are [example 2IPF] as an antioxidant to the gay polypropylene for 2g / 10 minutes. Respectively SHINOKKUSU 412S as the 0.1 weight section and a sulfur system antioxidant for Ir1010 and Ir168 The 0.2 weight section, 0.3 weight section addition of the zinc oxide (compound D) is carried out as a neutralizer by using Prifer3881 as the 0.2 weight section and a divalent-metal compound as the calcium stearate 0.05 weight section and Zn system ***** (compound A). After blending using a super mixer, melting kneading was carried out with the screw speed of 230 degrees C and 70rpm with the extruding press machine of 50mmphi, and pellet-like polypropylene was obtained. The polypropylene fiber was obtained for this like the example 1, and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 1.

[0031] Except having used the loadings of the Zn system ***** and the divalent-metal compound which are shown in Table 1 using IPF and MFR which are shown in three to example 9 table 1, and the gay polypropylene of molecular weight distribution, the polypropylene fiber was obtained like the example 2 and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 1.

[0032] Using the gay polypropylene of the IPF, MFR, and molecular weight distribution which are shown in example of comparison 1 table 1, except having not used *****, the polypropylene fiber was obtained like the example 1 and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 1.

[0033] the gay polypropylene of the IPF, MFR, and molecular weight distribution which are shown in two to example of comparison 3 table 1 -- using -- as ***** -- sorbitol system ***** (Compound B, NC-4 by Mitsui Toatsu Chemicals, Inc.) -- **** for the 0.2 weight sections -- things - except obtained the polypropylene fiber like the example 1, and evaluated the cement concrete moldings after autoclave curing (form maintenance nature, antibacterial, cement compatibility) The result is shown in Table 1.

[0034] The gay polypropylene of the IPF, MFR, and molecular weight distribution which are shown in four to example of comparison 5 table 1 is used, and it is ***** Except having considered as the loadings which show sorbitol system ***** (Compound B, JIBEN (2 (1 3) 4) zylidene sorbitol (FC-1)) in Table 1. the polypropylene fiber was obtained like the example 1 and the cement concrete

moldings after autoclave curing was evaluated (gestalt retentivity, antibacterial, cement compatibility). The result is shown in Table 1.

[0035] the gay polypropylene of the IPF, MFR, and molecular weight distribution which are shown in example of comparison 6 table 1 -- using -- as ***** -- shell ***** (compound C:hydroxy-JI (t-butyl benzoic acid) aluminum) -- **** for the 0.2 weight sections -- things -- except obtained the polypropylene fiber like the example 1, and evaluated the cement concrete moldings after autoclave curing (form maintenance nature, antibacterial, cement compatibility) The result is shown in Table 1.

[0036] The gay polypropylene of the IPF, MFR, and molecular weight distribution which are shown in example of comparison 7 table 1 is used, and it is ***** sorbitol system ***** (Compound B, NC-4 by Mitsui Toatsu Chemicals, Inc.) -- as the 0.5 weight section and a divalent-metal compound -- Compound D -- **** for the 0.5 weight sections -- things -- except obtained the polypropylene fiber like the example 2, and evaluated the cement concrete moldings after autoclave curing (form maintenance nature, antibacterial, cement compatibility) The result is shown in Table 1.

[0037]

[Table 1]

	実 施 例									比 較 例						
	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7
純粋なPP IPF (%)	98	97	96	97	97	98	97	95	97	93	97	97	93	92	97	97
MFR (g/10分)	2	2	3	8	2	2	2	2	50	8	8	50	8	2	2	3
分子量分布	5	7	9	4.5	7	7	5	5	4.5	3	3	3	6	6	7	7
化合物A (重量部)	0.2	0.2	0.2	0.2	0.5	1	0.5	0.5	0.5	—	—	—	—	—	—	—
化合物B (重量部)	—	—	—	—	—	—	—	—	—	—	0.2	0.2	0.2	0.1	—	0.5
化合物C (重量部)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.2	—
化合物D (重量部)	—	0.3	0.3	0.3	0.5	1	0.3	0.5	0.5	—	—	—	—	—	—	0.5
融点 Tm (°C)	172	172	172	171	173	175	173	171	171	161	170	168	163	160	171	170
TmE (°C)	177	178	177	176	179	180	179	176	176	169	175	172	171	165	176	178
耐水性	◎	○	○	◎	○	○	◎	◎	◎	◎	◎	◎	◎	◎	×	◎
延伸性	○	○	○	◎	○	○	◎	◎	◎	◎	◎	◎	◎	◎	×	○
養生後の形態保持性	◎	◎	◎	○	◎	◎	◎	◎	◎	×	×	×	×	×	◎	△
抗菌性	○	○	○	○	◎	◎	◎	◎	◎	×	×	×	×	×	×	×
セメント親和性	○	○	○	○	◎	◎	◎	◎	○	×	×	×	×	×	×	×

[0038] For 2g / 10 minutes, and molecular weight distribution, example 10MFR is [5 and ethylene concentration] as an antioxidant to the ethylene propylene random copolymer (it is described as Following RCP) it is [random copolymer] 0.2 % of the weight. Respectively SHINOKKUSU 412S as the 0.1 weight section and a sulfur system antioxidant for Ir1010 and Ir168 The 0.2 weight section, Are carried out Prifer3881 as a neutralizer and 0.3 weight section addition of the 0.2 weight section and the divalent-metal compound (compound D) is carried out as the calcium stearate 0.05 weight section and Zn system ***** (compound A). After blending using a super mixer, melting kneading was carried out with the screw speed of 230 degrees C and 70rpm with the extraction making machine of 50mmphi, and pellet-like polypropylene was obtained. The polypropylene fiber was obtained for this like the example 1, and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 2.

[0039] Except having considered as the loadings of the Zn system ***** and the divalent-metal compound which are shown in Table 2 using RCP of the ethylene content, MFR, and molecular weight distribution which are shown in 11 to example 13 table 2, the polypropylene fiber was obtained like the example 1 and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 2.

eight to example of comparison 9 table 2 is used, and it is *****. Except having considered as the loadings which show sorbitol system ***** (Compound B, JIBEN (2 (1 3) 4) zylidene sorbitol (EC-1)) in Table 2, the polypropylene fiber was obtained like the example 1 and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 2.

[0041] Using RCP of the ethylene content, MFR, and molecular weight distribution which are shown in example of comparison 10 table 2, except having used the 0.5 weight section for shell ***** (compound C) as ***** , the polypropylene fiber was obtained like the example 1 and the cement concrete moldings after autoclave curing was evaluated (form maintenance nature, antibacterial, cement compatibility). The result is shown in Table 2.

[0042]

[Table 2]

	実施例				比較例		
	10	11	12	13	8	9	10
RCP							
IPP含量 (重量%)	0.2	0.3	0.5	0.5	3.6	0.3	5
MFR (g/10分)	2	2	2	2	8	2	8
分子量分布	5	7	9	9	3	7	3
化合物A (重量部)	0.2	0.5	0.5	1	—	—	—
化合物B (重量部)	—	—	—	—	0.5	1	—
化合物C (重量部)	—	—	—	—	—	—	0.5
化合物D (重量部)	0.3	0.5	0.5	1	—	—	—
ポリプロピレン繊維							
TmD (°C)	168	167	166	167	143	165	135
TmB (°C)	174	174	175	176	158	171	150
耐水性	◎	◎	○	○	◎	○	◎
延伸性	◎	○	○	○	○	○	○
養生後の形態保持性	○	○	○	○	×	×	×
抗菌性	○	◎	◎	◎	×	×	×
セメント親和性	○	○	○	◎	×	×	×

[0043]

[Effect of the Invention] The polypropylene fiber of this invention is a high thermal-resistance polypropylene fiber obtained from the constituent which added the constituent or Zn content ***** , and the divalent-metal compound which added Zn content ***** in specific polypropylene, if it uses as a cement reinforcing agent, the fiber form is maintained under severe care of health, and is simultaneously equipped with the cement concrete compatibility on the front face of fiber, and antibacterial, and can fully demonstrate the effect as a reinforcing agent. Since the polypropylene fiber of this invention is used as fiber for cement concrete reinforcement of the fiber strengthening cement moldings used for the interior material for building materials, and sheathing materials and has antibacterial [on the reinforcement effect and the front face of thread] especially, it is the optimal polypropylene fiber for the fiber for interior reinforcement it is expected that the antibacterial effect in a moldings front face is.

[Translation done.]